The C2 Workstation and Data Replication over Disadvantaged Tactical Communication Links

Presentation held at the NATO RTO-IST Taskgroup 12 Workshop on September 11th&12th in Quebec, Canada

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Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
01 DEC 2007	**N/A**	

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
The C2 Workstation and Data Replication over Disadvantaged Tactical Communication Links	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **TNO Physics and Electronics Laboratory**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release, distribution unlimited.

13. SUPPLEMENTARY NOTES

14. ABSTRACT

15. SUBJECT TERMS

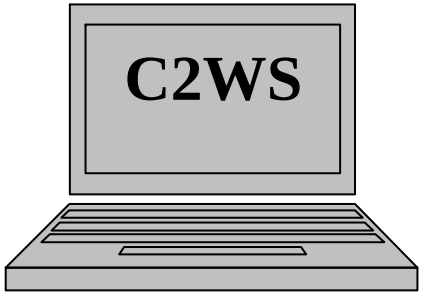
16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT **unclassified**	b. ABSTRACT **unclassified**	c. THIS PAGE **unclassified**	**UU**	**14**	

Part 1. Introduction

Structure of this Presentation:

- Part 1. Introduction
- Part 2. The Problem Domain
- Part 3. The C2 Workstation (C2WS)
- Part 4. Conclusions and Recommendations

Part 2. The Problem Domain for this Presentation



Requirements

Data Distribution

Constraints

Tactical Communication Link

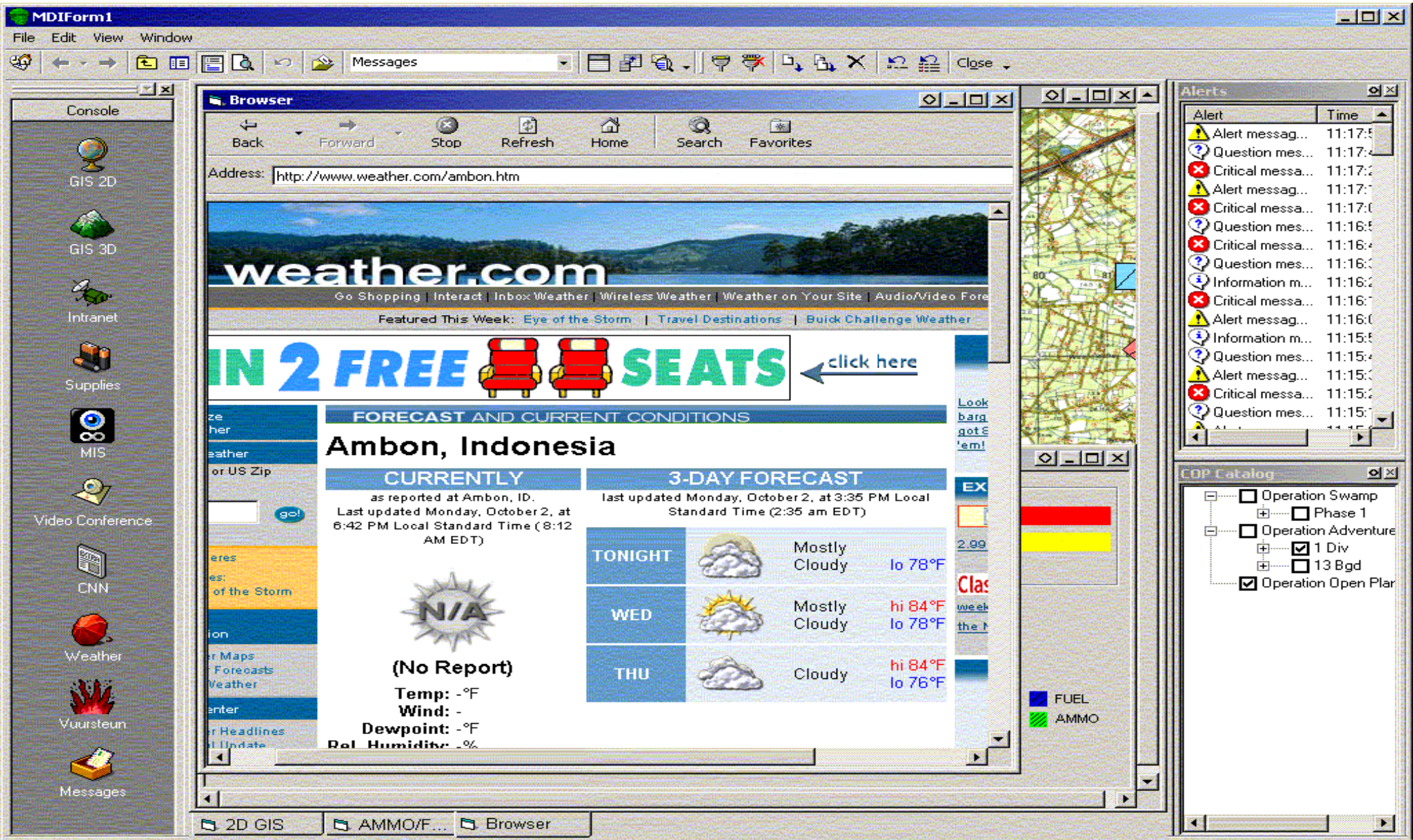
How to:

-**Collaborative working**
-Selective data distribution
-(Re-)Synchronisation
- Stand alone operation
-**Security**

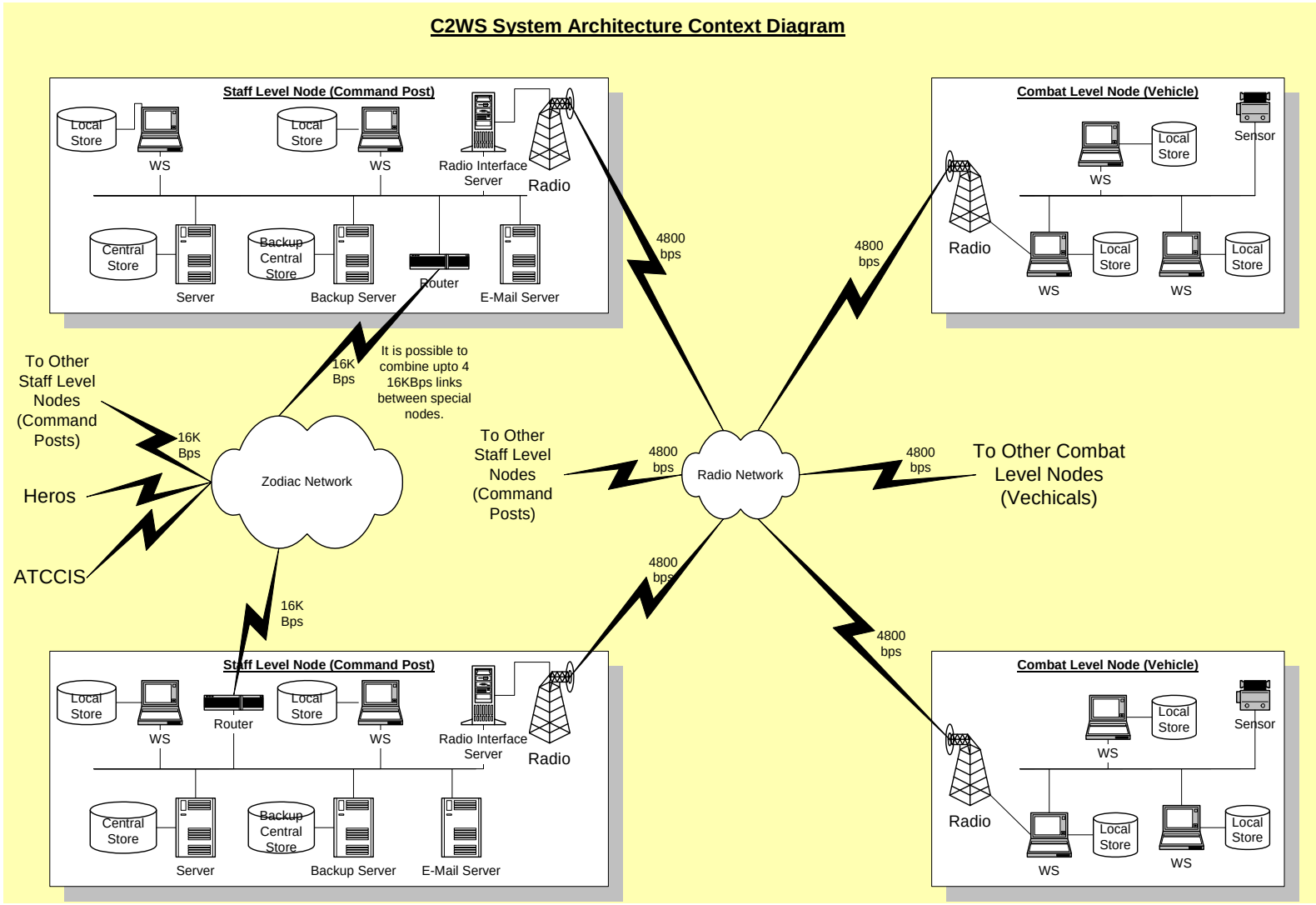
Despite:

-Limited bandwidth
-Limited reach
-Frequent disconnects
-Latency
-Out of order delivery
-Missing data packages
-Corrupt data packages
-**Dynamic topology**

Part 3. The C2 Workstation (C2WS)

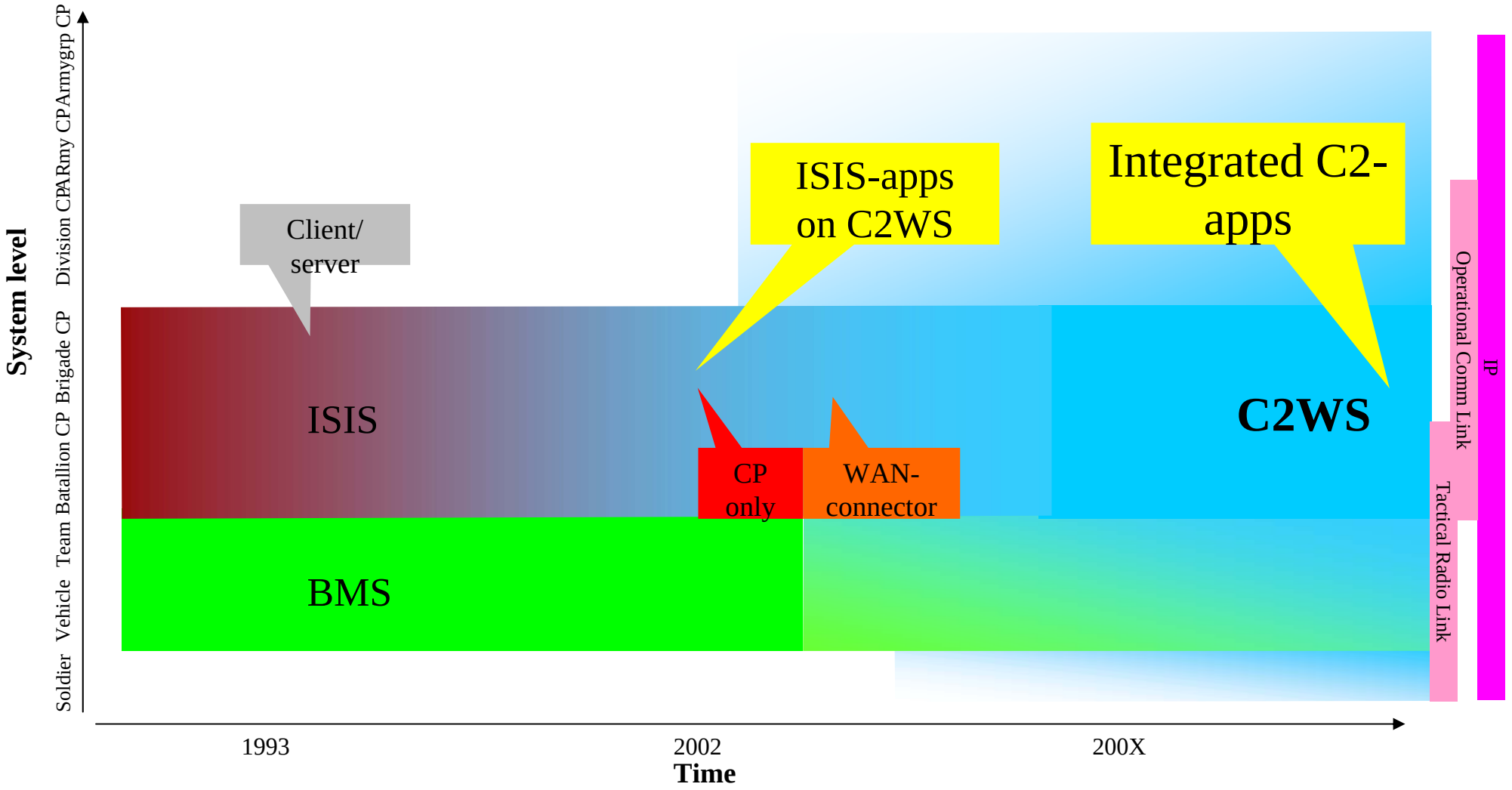


C2WS Physical Environment



C2WS Evolution

Basic Functionality - Stability - Performance – Data Distribution – Management – Security – Extend Functionality



C2WS Design Decisions I - Workstation

- Local data store (client **or** server!)
  Each workstation is a replication node!
- Overlays to group information
- Publish/Subscribe on a per Overlay basis
  - no servers, no single point of failure
  - Catalog of available information
- Parallel synchronisation and processing of (out of order) messages

C2WS Design Decisions II - Data Distribution I

- Supports Overlay Concept
- Publish/Subscribe – COTS product
- C2WS messages
  - unit of data distribution
  - can be processed ‘out of order’
  - can be distributed with different QoS setttings (future)
  - can be encrypted and signed (future)
  - portable data (XML) -> C2XML
  - ‘(delta) object completeness’

C2WS Design Decisions III - Data Distribution II

- Synchronization
  - For subscribed Overlays:
    - Active Information and/or
    - Historic Information (time period)
    - Configurable data loggers/synchronization servers
  - Heartbeat
- Multi-master replication with loose consistency & convergence

Collaborative work on a shared Overlay

- Last update wins
  - Version numbers on object-attribute values
  - Conflict resolution on a per attribute basis only.
- Data conflict
  - Normal (foreign key, transactional) integrity is not enforced in favor of availability.
  - Left to end users after synchronizing
  - Replication mechanism only provides convergence
- Differing view - different overlay
  - Within an Overlay, data will most likely be contributory than conflicting

C2WS versus ATCCIS/MIP DEM

ATCCIS	C2WS
Database replication	Info bus
Contracting	Publish/subscribe per overlay
Contracts (predefined)	Overlays (flexible)
Relational	Object oriented
Proprietary PDU syntax	XML
Fixed QoS	COTS MOM
LC2IEDM	C3I info model
Ownership	Update anywhere; access control lists/ last wins
Database table changes	Object(change)s
Full bulk synchronization	Synchronization options
Increments after full bulk	Concurrent synchronization & regular data exchange

Part 4. Conclusions & Recommendations

- C2WS principles
  - Data organized in Overlays
  - Update anywhere, collaborative work
  - Use Publish-Subscribe paradigm
- Challenges:
  - Proof of the pudding...
  - How to use Overlays?
  - vehicle level and down?
  - Combine security & publish-subscribe?

Conclusions & Recommendations

- Recommendations
  - Contact TNO and/or C2 Support Centre
  - Join MIP/Seawg
  - Take care

Questions?